CLAIMS: I claim:

1. A machine used in computing one of more sums of products, wherein at least one of said sums of products is not a desired product of two numbers, comprising:

   a. a first number represented in a first finite-precision numeric format, said first number being a member of a first multiplier-defined restricted set

   b. a second number represented in a second finite-precision numeric format

   c. first multiplier means for computing a first product equal to the product of said first number and said second number, where

      i. said first multiplier means can compute the product of a first multiplier input and a second multiplier input when the first multiplier input is any number from said first multiplier-defined restricted set and the second multiplier input is said second number

      ii. said first multiplier means cannot compute the product of a first multiplier input and a second multiplier input when the first multiplier input is not a member of said first multiplier-defined restricted set, the second multiplier input is said second number, the first multiplier input has numeric value not equal to zero, and the second multiplier input has numeric value not equal to zero

      iii. said first multiplier-defined restricted set has more than one member

      iv. said first multiplier-defined restricted set does not include all the members of a first unrestricted set, said first unrestricted set including all numbers having said first finite-precision numeric format and not including numbers in other finite-precision numeric formats

   whereby said first product may be computed with reduced complexity compared to computation of said first product using general multiplier means, said general multiplier means being able to compute the product of said second number and any member of said first unrestricted set.

2.   The machine of claim **1** in which said first multiplier-defined restricted set includes a number having a numeric value zero.

3.   The machine of claim **1** in which said first multiplier-defined restricted set includes a first member having numeric value not equal to zero, positive one, or negative one and a second member having numeric value that is not equal to zero, positive one, or negative one.

4.   The machine of claim **1** in which said first multiplier-defined restricted set has exactly two members.

5.   The machine of claim **4** in which one member of said first multiplier-defined restricted set is a number having a numeric value zero.

6.   The machine of claim **4** in which each member of said first multiplier-defined restricted set is the negative of the other member.

7.   The machine of claim **4** in which each member of said first multiplier-defined restricted can be obtained by shifting the representation element values of the other member.

8.   The machine of claim **1** in which said first multiplier-defined restricted set has more than two members.

9.   The machine of claim **1** wherein said first multiplier-defined restricted set has a first member and a second member with the following properties:

a.   said first member is not an integer multiple of said second member

b.   said second member is not an integer multiple of said first member

whereby said first multiplier-defined restricted set has at least two members that are related by at least one shift and one addition.

10. The machine of claim **1**, further including:

    a. a third number represented in a third finite-precision numeric format, said third number being a member of a second multiplier-defined restricted set

    b. a fourth number represented in a fourth finite-precision numeric format

    c. second multiplier means for computing a second product equal to the product of said third number and said fourth number, where

        i. said second multiplier means can compute the product of a first multiplier input and a second multiplier input when the first multiplier input is any number from said second multiplier-defined restricted set and the second multiplier input is said fourth number

        ii. said second multiplier means cannot compute the product of a first multiplier input and a second multiplier input when the first multiplier input is not a member of said second multiplier-defined restricted set, the second multiplier input is said fourth number, the first multiplier input has numeric value not equal to zero, and the second multiplier input has numeric value not equal to zero

        iii. said second multiplier-defined restricted set has more than one member

whereby said first product and said second product may be computed with lower complexity than if general multiplier means were used to compute each product.

11. The machine of claim **10** wherein said second multiplier-defined restricted set does not include all members of a second unrestricted set, said second unrestricted set including all numbers having said third finite-precision numeric format and not including numbers in other finite-precision numeric formats, whereby each of said first multiplier means and said second multiplier means is neither constant multiplier means nor general multiplier means.

12. The machine of claim **10** wherein said first multiplier-defined restricted set and said second multiplier-defined restricted set do not have any common members.

13. The machine of claim **1**, in which:
   a. said second number is a member of a second multiplier-defined restricted set
   b. said first multiplier means
      i. can compute the product of a first multiplier input and a second multiplier input when the first multiplier input is a member of said first multiplier-defined restricted set and the second multiplier input is a member of said second multiplier-defined restricted set
      ii. cannot compute the product of a first multiplier input and a second multiplier input when the first multiplier input is not a member of said first multiplier-defined restricted set, the second multiplier input is a member of said second multiplier-defined restricted set, the first multiplier input has numeric value not equal to zero, and the second multiplier input has numeric value not equal to zero
      iii. cannot compute the product of a first multiplier input and a second multiplier input when the first multiplier input is a member of said first multiplier-defined restricted set, the second multiplier input is not a member of said second multiplier-defined restricted set, the first multiplier input has numeric value not equal to zero, and the second multiplier input has numeric value not equal to zero
   c. said second multiplier-defined restricted set does not include all the members of a second unrestricted set, said second unrestricted set including all numbers having said second finite-precision numeric format and not including numbers in other finite-precision numeric formats
   whereby said first multiplier means can have lower complexity than if it must be able to compute the product of said first number and any number in said second unrestricted set.

14. The machine of claim **13** in which said second multiplier-defined restricted set has exactly one member.

15. The machine of claim **14** in which the one member of said second multiplier-defined restricted set has numeric value not equal to zero, positive one, or negative one.

16. The machine of claim **13** in which said second multiplier-defined restricted set has more than one member.

17. A method used in computing one or more sums of products, wherein at least one of said sums of products is not a desired product of two numbers, comprising first multiplication of a first number by a second number to produce a first product equal to the product of said first number and said second number, where:

    a. said first number is represented in a first finite-precision numeric format, said first number being a member of a first multiplication-defined restricted set

    b. said second number is represented in a second finite-precision numeric format

    c. said first multiplication can compute the product of a first multiplication input and a second multiplication input when the first multiplication input is any number from said first multiplication-defined restricted set and the second multiplication input is said second number

    d. said first multiplication cannot compute the product of a first multiplication input and a second multiplication input when the first multiplication input is not a member of said first multiplication-defined restricted set, the second multiplication input is said second number, the first multiplication input has numeric value not equal to zero, and the second multiplication input has numeric value not equal to zero

30

e. said first multiplication-defined restricted set has more than one member

f. said first multiplication-defined restricted set does not include all the members of a first unrestricted set, said first unrestricted set including all numbers having said first finite-precision numeric format and not including numbers in other numeric formats

whereby said first product may be computed with reduced complexity compared to computation of said first product using general multiplication, said general multiplication being able to compute the product of said second number and any member of said first unrestricted set.

18. The method of claim 17 in which said first multiplication-defined restricted set includes the number zero.

19. The method of claim 17 in which said first multiplication-defined restricted set includes a first member with numeric value not equal to zero, positive one, or negative one and a second member with numeric value not equal to zero, positive one, or negative one.

20. The method of claim 17 in which said first multiplication-defined restricted set has exactly two members.

21. The method of claim 20 in which one member of said first multiplication-defined restricted set is the number zero.

22. The method of claim 20 in which each member of said first multiplication-defined restricted set is the negative of the other member.

23. The method of claim 20 in which each member of said first multiplication-defined restricted set can be obtained by shifting the representation element values of the other member.

24. The method of claim **17** in which said first multiplication-defined restricted set has more than two members.

25. The method of claim **17** wherein said first multiplication-defined restricted set has a first member and a second member with the following properties:

a. said first member is not a integer multiple of said second member

b. said second member is not an integer multiple of said first member whereby said first multiplication-defined restricted set has at least two members that are related by at least one shift and one addition.

26. The method of claim **17**, further including second multiplication of a third number by a fourth number to produce a second product equal to the product of said third number and said fourth number, where:

a. said third number is represented in a third finite-precision numeric format, said third number being a member of a second multiplication-defined restricted set

b. said fourth number is represented in a fourth finite-precision numeric format

c. said second multiplication method can compute the product of a first multiplication input and a second multiplication input when the first multiplication input is any number from said second multiplication-defined restricted set and the second multiplication input is said fourth number

d. said second multiplication method cannot compute the product of a first multiplication input and a second multiplication input when the first multiplication input is not a member of said second multiplication-defined restricted set, the second multiplication input is said fourth number, the first multiplication input has numeric value not equal to zero, and the second multiplication input has numeric value not equal to zero

e. said second multiplication-defined restricted set has more than one member

32

whereby said first product and said second product may be computed with lower complexity than if general multiplication methods were used to compute each product.

27. The method of claim **26** wherein said second multiplication-defined restricted set does not include all members of a second unrestricted set, said second unrestricted set including all numbers having said third finite-precision numeric format and not including numbers in other finite-precision numeric formats, whereby each of said first multiplication and said second multiplication is neither constant multiplication nor general multiplication.

28. The method of claim **26** wherein said first multiplication-defined restricted set and said second multiplication-defined restricted set do not have any common members.

29. The method of claim **17** in which:

a. said second number is a member of a second multiplication-defined restricted set

b. the method of said first multiplication

   i. can compute the product of a first multiplication input and a second multiplication input when the first multiplication input is a member of said first multiplication-defined restricted set and the second multiplication input is a member of said second multiplication-defined restricted set

   ii. cannot compute the product of a first multiplication input and a second multiplication input when the first multiplication input is not a member of said first multiplication-defined restricted set, the second multiplication input is a member of said second multiplication-defined restricted set, the first multiplication input has numeric value not equal to zero, and the second multiplication input has numeric value not equal to zero

iii. cannot compute the product of a first multiplication input and a second multiplication input when the first multiplication input is a member of said first multiplication-defined restricted set, the second multiplication input is not a member of said second multiplication-defined restricted set, the first multiplication input has numeric value not equal to zero, and the second multiplication input has numeric value not equal to zero

c. said second multiplication-defined restricted set does not include all the members of a second unrestricted set, said second unrestricted set including all numbers having said second finite-precision numeric format and not including numbers in other finite-precision numeric formats whereby the method of said first multiplication can have lower complexity than if it must be able to compute the product of said first number and any number in said second unrestricted set.

30. The method of claim **29** in which said second multiplication-defined restricted set has exactly one member.

31. The method of claim **30** in which the one member of said second multiplication-defined restricted set has numeric value not equal to zero, positive one, or negative one.

32. The machine of claim **29** in which said second multiplication-defined restricted set has more than one member.